

Right here the importance of definitely determining the vitality of typhoid germs under external conditions—away from their natural home, the human intestine—becomes apparent. If the typhoid germ dies quickly in soil or in water, then the water route is much less dangerous than it would be if this germ lived weeks, months, or years under these external conditions. They may live in ordinary soil several months. If in soil kept moist by a leaking drain, or in soil frequently moistened with beef soup, they will live two months. In fecal matter they will live longer than in ordinary soil. They have been found in garden soil which had been fertilized fourteen days previously with the contents of a five-months-old privy vault. The germ will live three months in distilled water. Its life in other water depends upon a number of variable factors, such as movement, light, chemical substances, and particularly upon the presence or absence of other bacteria or germs, many of which are inimical to the typhoid germ. They have been found alive eight days in drinking water, and they will very probably live a much longer time in the mud and scrapings from wells and reservoirs. Evidence indicates that these germs may live four or five days and travel a distance of eighty-five miles in river water. They have been known to live three months in ice. About 40 per cent of all typhoid in the United States is believed to be water borne.

Facts, proving the relation of water to the disease, are variations in the frequency of typhoid in two cities under identical conditions with the exception of water supply, which is taken from different sources; variation in frequency among the inhabitants of a single town which has two different water supplies; variation in the frequency of the disease in the same town before and after the installation of a filter, which is known to remove about 98 per cent of the germs in water. Hamburg, Germany, taking her water supply from the Elbe River close to where the city sewers emptied, had, between 1885 and 1888, 15,800 cases of typhoid. Wandsbeck, a neighboring city, with a different water supply, was practically free from the disease. In 1901, an epidemic occurred in New Haven, Connecticut, which resulted in 514 cases with 72 deaths. New Haven had five distinct water supplies. On one of these systems the source of the infection was found to be a patient who deposited the undisinfected stool where it was washed into the water supply. *Ninety-six* per cent of all the cases of this epidemic occurred in those using the polluted water supply. Only 4 per cent occurred in those using water from the other four systems. The effect of filtration, a process that removes 98 per cent of all the germs contained in water, is well shown in a number of instances. Paris put in a public filter and her typhoid death rate fell from 142 to only 17 per 100,000. Munich put in a filter and reduced a typhoid death rate from 291 to 10 per 100,000. Hamburg filtered her water supply and reduced her typhoid death rate from 40 to 7.2 per 100,000. Lawrence, Massachusetts, put in a public filter and her typhoid death rate dropped from 121 to 26 per 100,000.